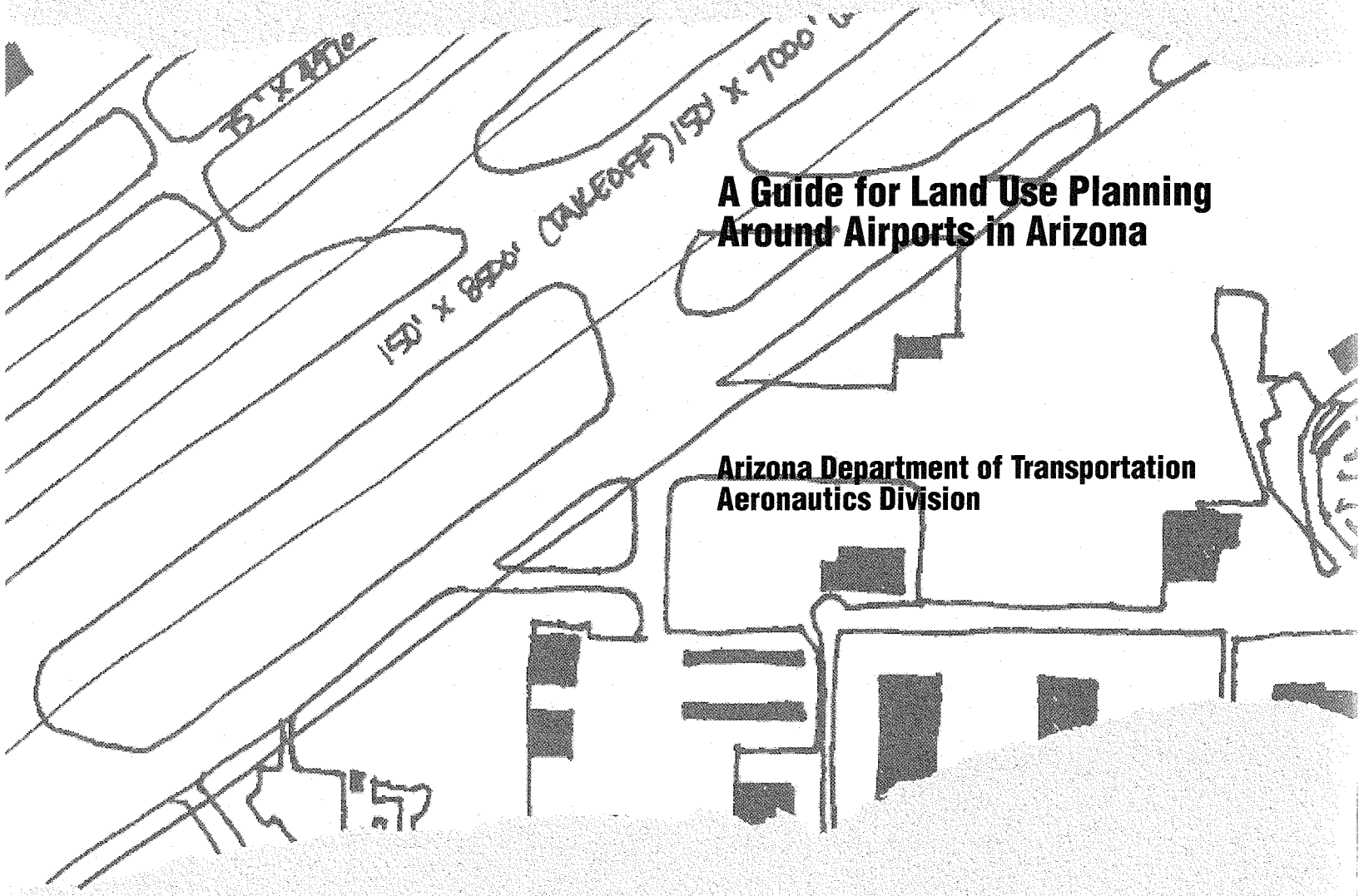


A Guide for Land Use Planning Around Airports in Arizona

Arizona Department of Transportation
Aeronautics Division

A Guide for Land Use Planning Around Airports in Arizona

Prepared for
Arizona Department of Transportation
Aeronautics Division

April, 1993

Introduction

The **Guide for Land Use Planning Around Airports in Arizona** focuses on two areas typically used in establishing compatible relationships between an airport and the area around the airport. This surrounding area may not necessarily be within the control of the airport jurisdictional entity, but may currently or potentially be affected by the operations at the airport and, in turn, influence the operational and developmental aspects of the airport itself. This surrounding area is referred to as the airport environs. The two areas covered here are *land use* and the *height of objects* at airports and within the airport environs.

Depending on the nature and magnitude of the airport and its operations, the airport environs vary significantly in coverage. The more immediate geographical area most commonly involves land use considerations whereas the extended area more typically involves considerations of object height and relation of those objects with the approaches and departures to and from the aviation facility. However, both land use and object height may be collective issues in either area. Both are quite important considerations, thereby providing the impetus for this set of methods and guidelines for land use planning.

The purpose of this document is twofold: to promote compatible relationships between airports and the environs surrounding these community facilities and to provide information and guidelines for such orderly development. This document may be used by a variety of individuals and entities in the pursuit of compatible airport and community development, including elected officials; planning commission and zoning board members; airport boards and authorities; city, county and state staff members charged with the responsibility for assuring compatibility; developers; and other appropriate decision makers, to note a few. Because the effects of an airport can, and in most instances do encircle a rather large area (usually a larger area than that represented by the airport boundaries), the concerned and affected individuals and entities are encompassing, often involving multi-jurisdictional situations and cooperation. This obviously makes the coordination of many activities and interests necessary to maintain or ultimately achieve compatible airport and land use relationships.

Planning for land use compatibility is a local responsibility. To accomplish the goal of achieving and promoting land use compatibility, communities have the authority to implement controls that govern land uses and height of objects within the vicinity of airports. This document is intended to assist in that effort, but is advisory, rather than mandating, in nature. Each airport and each community is unique; the use of the information in this document should be adapted to each situation as appropriate and to the degree deemed necessary by each jurisdictional entity.

This **Guide for Land Use Planning Around Airports in Arizona** has been prepared by Barnard Dunkelberg & Company, Inc., Airport and Environmental Consultants, under the direction and supervision of the Arizona Department of Transportation/Aeronautics Division. The Division strongly recommends that each airport and community in the State of Arizona implement the recommendations of this document as appropriate to promote airport and airport environs compatibility and preserve the ability of the airport and its environs to realize full development potential.

Table of Contents

The Role of Aviation and Planning for the Future

Perhaps the benefits of aviation to a community and to a state can be categorized into two areas: convenience and economic development, although both are quite interrelated. Air transportation offers an unexcelled opportunity for quickly and efficiently transporting people and goods to interstate and intrastate as well as worldwide markets. Air transportation, whether commercial or private, serves both the business traveler and the recreational traveler with access to and from a community or the state in an efficient and cost-effective manner. At the same time, it provides an efficient mean for the movement of goods and responsive access to medical facilities to isolated communities and non-urban areas of the state.

The availability of an airport in a community directly and indirectly benefits localities through enhanced potential for industrial development (which depends on convenient and reliable air access), increased access to recreational opportunities in a given area of the state and, in turn, the establishment of jobs as these development and use opportunities transpire. These benefits may be more specifically described in terms of economic activity or, perhaps more appropriate, economic impact. The economic impact of aviation in the State of Arizona has been estimated as exceeding eleven billion dollars.

The aviation system in the State of Arizona and the use of that system has continued to grow and expand, particularly during the past two decades. Expanded airport facilities, increased aircraft registrations, increased pilot registrations, increased aircraft operations, increased passengers at the commercial service airports, and increased cargo shipments are demonstrations of this growth.

The development of airports, the building of a community and the boosting of an economy are synonymous terms and represent interdependent activities. Because of increasing competition, changing roles, accommodation of today's aviation needs, community awareness and economic demands, planning for the future of the airport and the community is a necessity. With that planning, the opportunities are excellent for associated airport usage and development activity on or near airports and the achievement of a compatible co-existence between the airport and its environs.

The airport is a community facility. It is a facility that offers great potential to the future of a community in terms of economic enhancement and community development. It is an asset that requires commitment and dedication from the community and appointed individuals representing the community to establish a program for airport and environs development that ensures consistent and compatible growth of both community elements.

realize its full economic potential and benefit to the community.

The Federal Aviation Administration has developed guidelines for determining land use compatibilities and incompatibilities. These guidelines are contained in Federal Aviation Regulations (FAR) Part 150. These guidelines may be adopted by a community or other jurisdictional entity as provided, or they may be amended to best suit the needs of the a particular jurisdiction. The *FAR Part 150 Land Use Compatibility Guidelines* are presented in the following table.

Compatible and Incompatible Land Uses

There are two major factors that are to be considered and analyzed as a means of determining how a given tract of land within the airport environs may be used in compliance with compatible land use guidelines. These factors include the height of objects or structures to be situated on the land and the level of aircraft-generated noise which impacts or is expected to impact the land. A technical analysis of each of these considerations yields certain criteria that should be followed and the resultant land uses which are appropriate. Land uses regarded as compatible or incompatible and relative heights of structures considered appropriate depend on the type of airport and the operational characteristics of the facility. Low activity airports without instrument landing approaches, for instance, generate minimal impacts and require controls which are less significant in terms of the size of impact area. On the other hand, airports that have higher levels of operational activity, thereby generating greater levels of noise and more restrictive approach and departure procedures, would create the need for more significant controls and consideration of a comparatively larger geographical area. In essence, the geographical area of consideration varies, depending on the nature of the airport and its operational characteristics, and is typically based on the area created by the various noise level contours as well as the area created by the various imaginary surfaces around an airport associated with height hazard zoning. However, accepted compatible land uses and allowable struture height is, in relative terms, the same within given noise contours and height hazard imaginary surfaces.

Of the various general categories of land use, residential land use is the dominant land use since it usually occupies larger areas and it is the subject of more aircraft-generated noise impacts resulting from operations and aircraft engine-related activities due to its nature and resultant sensitivity. On this basis, it is recognized as perhaps the most incompatible land use within the vicinity of an airport.

Other uses are also considered to be incompatible in relation to the airport and its activities. These include such activities as schools, churches, hospitals and other health-care institutions, and outdoor activity centers (such as amphitheaters, parks and recreation areas), among others. While these uses are sensitive to aircraft-generated noise impacts, the magnitude of these impacts is not as prominent as it is with residential land use simply due to the considerably less land area occupied by these uses and the comparatively low number of units.

During the process of planning for the future development of the airport and the environs around the airport, particular care should be taken to assure proper relationships. The most effective relationship is the absence of residential land uses and other noise sensitive land uses (i.e., schools, churches, hospitals, among others) within the airport's environs (namely that area encompassed within a specific noise contour). Usually, the noise contour used for land use planning purposes is the DNL 65 contour; however, jurisdictional entities may choose to adopt a baseline contour with *more* land area coverage, such as the DNL 60 or 55 contour. Such a practice permits greater control of an area within the community in the interest of protecting an area from aircraft-generated noise encroachment as well as permitting the airport to realize its full economic potential and benefit to the community.

The Federal Aviation Administration has developed guidelines for determining land use compatibilities and incompatibilities. These guidelines are contained in Federal Aviation Regulations (FAR) Part 150. These guidelines may be adopted by a community or other jurisdictional entity as provided, or they may be amended to best suit the needs of the a particular jurisdiction. The *FAR Part 150 Land Use Compatibility Guidelines* are presented in the following table.

Land Use	Yearly Day-Night Sound Level(DNL) in decibels					
	Below 65	*65-70*	*70-75*	*75-80*	*80-85*	*Over 85*
Residential						
Residential, other than mobile homes and transient lodgings	Y	N(1)	N(1)	N	N	N
Mobile home parks	Y	N	N	N	N	N
Transient lodgings	Y	N(1)	N(1)	N(1)	N	N
Public Use						
Schools	Y	N(1)1	N(1)	N	N	N
Hospitals and nursing homes	Y	25	30	N	N	N
Churches, auditoriums and concert halls	Y	25	30	N	N	N
Governmental services	Y	Y	25	30	N	N
Transportation	Y	Y	Y(2)	Y(3)	Y(4)	Y(4)
Parking	Y	Y	Y(2)	Y(3)	Y(4)	N
Commercial Use						
Offices, business and professional	Y	Y	25	30	N	N
Wholesale and retail-building materials, hardware and farm equipment	Y	Y	Y(2)	Y(3)	Y(4)	N
Retail trade-general	Y	Y	25	30	N	N
Utilities	Y	Y	Y(2)	Y(3)	Y(4)	N
Communication	Y	Y	25	30	N	N
Manufacturing and Production						
Manufacturing, general	Y	Y	Y(2)	Y(3)	Y(4)	N
Photographic and optical	Y	Y	25	30	N	N
Agriculture (except livestock) and forestry	Y	Y(6)	Y(7)	Y(8)	Y(8)	Y(8)
Livestock farming and breeding	Y	Y(6)	Y(7)	N	N	N
Mining and fishing, resource production and extraction	Y	Y	Y	Y	Y	Y
Recreational						
Outdoor sports arenas and spectator sports	Y	Y(5)	Y(5)	N	N	N
Outdoor music shells, amphitheaters	Y	N	N	N	N	N
Nature exhibits and zoos	Y	Y	N	N	N	N
Amusements, parks, resorts and camps	Y	Y	Y	N	N	N
Golf courses, riding stables and water recreation	Y	Y	25	30	N	N

Numbers in parentheses refer to notes.

* The designations contained in this table do not constitute a Federal determination that any use of land covered by the program is acceptable or unacceptable under Federal, State or local law. The responsibility for determining the acceptable and permissible land uses and the relationship between specific properties and specific noise contours rests with the local authorities. FAA determinations under Part 150 are not intended to substitute federally determined land uses for those determined to be appropriate by local authorities in response to locally determined needs and values in achieving noise compatible land uses.

KEY TO TABLE 1

SLUCM	Standard Land Use Coding Manual.
Y(Yes)	Land Use and related structures compatible without restrictions.
N(No)	Land Use and related structures are not compatible and should be prohibited.
NLR	Noise Level Reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into the design and
25, 30 or 35	Land Use and related structures generally compatible; measures to achieve NLR of 25, 30 or 35 dB must be incorporated into design and construction of structure.

NOTES

(1) Where the community determines that residential or school uses must be allowed, measures to achieve outdoor to indoor Noise Level Reduction (NLR) of at least 25 dB to 30 dB should be incorporated into building codes and be considered in individual approvals. Normal residential construction can be expected to provide a NLR of 20 dB, thus, the reduction requirements are often stated as 5, 10 or 15 dB over standard construction and normally assume mechanical ventilation and closed windows yearround. However, the use of NLR criteria will not eliminate outdoor noise problems.

(2) Measures to achieve NLR of 25 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.

(3) Measures to achieve NLR of 30 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.

(4) Measures to achieve NLR of 35 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.

(5) Land use compatible provided that special sound reinforcement systems are installed.

(6) Residential buildings require an NLR of 25.

(7) Residential buildings require an NLR of 30.

(8) Residential buildings not permitted.

Source: FAR Part 150

Aircraft Noise

Noise is defined as unwanted sound. Although we are surrounded by noise sources inside and outside our homes, aircraft noise can be more of an issue near airports. This issue has become particularly prominent since the introduction of the jet engine and the increased number of both commercial service and general aviation jet aircraft operations .

There are perhaps several reasons for this increased awareness. Obviously, the fact that the jet engine is a significant noise generator is an underlying reason. This is coupled with the fact that jet aircraft, whether civilian or military, or large or small, require a greater amount of operating area, or airspace, in turn influencing the area of coverage of noise intrusion and potentially exposing a larger segment of the population. Additionally, just the growth in the airline industry and the convenience of airline travel, resulting in an increase in the number of passengers and cargo, has led to a significant increase in the number of jet aircraft operations and a corresponding level of aircraft-generated noise exposure.

Noise affects each person differently; perceptions of various noise sources and associated levels of sensitivity range widely. Additionally, a single noise event of a particular noise source may or may not be annoying, depending on the individual and distance from the source, but, in all likelihood, will be soon forgotten. However, a repetition of these single events will increase the intensity of the noise and will result in an increased level of annoyance.

In order to understand an aircraft-generated noise, a quantifiable way of measuring and describing aircraft noise has been developed. Noise is measured in terms of

COMPARATIVE NOISE LEVELS

Activity	dB(A) Levels
Rustling Leaves	20
Room in Quiet Dwelling at Midnight	32
Soft Whisper at 5 feet	34
Men's Clothing Department of Large Store	53
Window Air Conditioner	55
Conversational Speech	60
Household Department of Large Store	62
Busy Restaurant	65
Typing Pool	65
Vacuum Cleaner in House (at 10 feet)	69
Ringing Alarm Clock (at 2 feet)	80
Loudly Reproduced Orchestral Music in Large Room	82
Printing Press Plant (Medium size automatic)	86
Heavy City Traffic	92
Heavy Diesel-Propelled Vehicle (at 25 feet)	92
Air Grinder	95
Cut-off Saw	97
Home Lawn Mower	98
Turbine Condenser	98
150 Cubic Foot Air Conditioner	100
Banging of Steel Plate	104
Air Hammer	107
Jet Airliner (500 feet overhead)	115

NOTE: Prolonged levels over 85 dB(A) represent beginning of hearing damage. Adapted from Impact of Noise on People, Federal Aviation Administration

decibels, a logarithmic scale of loudness. It is described in terms of A-weighted decibels. This approach reflects human perception of loudness by accounting for the human ear's varying sensitivity to sound at different frequencies.

An aircraft noise event begins when an aircraft approaches close enough to a person such that its noise exceeds the ambient noise level of one's surroundings. As the aircraft gets closer it gets louder, eventually reaching a maximum noise level (referred to as Lmax). As the aircraft passes, it gets farther away until its noise level is below ambient noise levels. The noise event may last from twenty seconds to several minutes, depending on the background noise level and the speed and distance to the aircraft. The acoustic energy of this noise event is called the Sound Exposure Level (SEL).

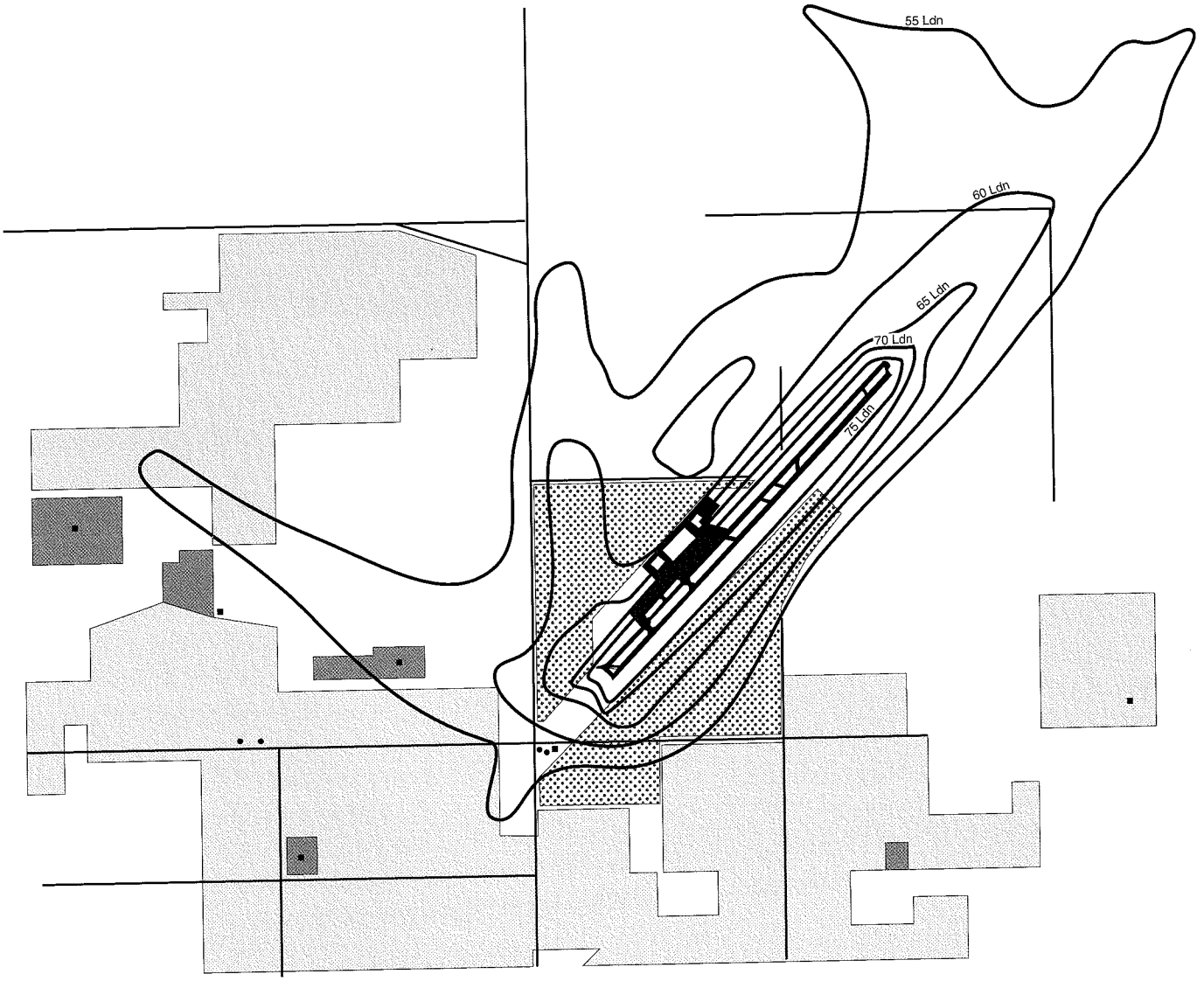
In order to determine the noise environment, the effect of the number of noise events over a 24-hour period and the time of occurrence, the Day-Night Noise Level (or DNL) at a given location is measured . DNL penalizes any noise event at night (generally defined as that time period between 10:00 p.m. and 7:00 a.m.) to account for increased human sensitivity to noise at night. Airport noise levels are typically reported in terms of the DNL measurement scale. The preceding table, entitled *Comparative Noise Levels*, provides an indication of the anticipated effects of noise on people for the various average day-night levels of sound.

Illustrating Aircraft Generated Noise

To characterize the noise environment of an airport and to illustrate the magnitude and relative coverage of aircraft-generated noise influence on the area surrounding an airport, the Federal Aviation Administration developed a computer program designed to simulate results of noise measurements at an airport in lieu of those measurements actually being taken at a particular location. The computer program is the Integrated Noise Model (INM), with the original version being created in November, 1979. Since that time, the INM has been revised and updated several times. The latest version of the model, Version 3.10 (dated August, 1992), reflects the latest input characteristics. It provides a quite accurate portrayal of the noise environment at an airport based on the operational characteristics of an appropriate composition and frequency of aircraft at applicable airport elevations and temperatures and along specified flight tracks.

Simply stated, the Integrated Noise Model calculates the DNL levels associated with the type, frequency and flight tracks of the aircraft which currently use the airport and those which are expected to use the facility at some designated point in the future. Points having the same DNL can be connected resulting in exposure contours for various sound levels. These sound levels are typically described as DNL 65, 70 and 75 noise contours, with larger or smaller intervals (DNL 55, 60 and 80) also being rather commonly demonstrated. As a note of reference, the smaller the DNL number, the less the amount of noise and resultant impact but the greater the size and the resultant amount of coverage; conversely, the larger the DNL number, the greater the amount of noise and resultant impact but the smaller the size and resultant amount of coverage. This concept is simply based on the relationship of the aircraft to the ground and the airport: the farther the aircraft is from the airport, the greater the distance to the ground and the proportionate decrease in impact. These noise contours are illustrated on the following illustration.

As mentioned, both existing and projected noise contours may be developed. These existing and future noise contours, which may be based on various airport configurations, expected aircraft types and projected operational levels, can then be used to establish compatible relationships within the airport environs based on community-based determinations as to those land use types which are considered to be compatible or incompatible within certain sound exposure levels as described by the noise contours. These contours are typically illustrated on a map which portrays the airport, the surface transportation system, and, in many cases, either existing land use or future land use proposals, as appropriate. Through this procedure, inconsistencies and incompatibilities can be identified and, ultimately, strategies can be developed for resolution of these occurrences or for the preservation of appropriate relationships between the airport and its environs.



Sample Noise Contour Map

N

Not to Scale
For Illustration Purposes Only

- Residential
- Commercial/Office
- Open/Agricultural
- Public
- Schools
- Churches
- Noise Contour

Planning for Compatibility

Aircraft Noise and Land Use Planning

Introduction

Planning for airports and the areas around them which are influenced by the inherent characteristics of such a facility, as well as planning for the airport environs which can also impact the development potential and even airport operations, can be accomplished at several levels of interest and jurisdiction. Planning for airports, and to a great extent planning for the airport environs, occurs at the federal, state, region and local levels through airport system planning, airport master planning efforts, and land use compatibility planning. Through regional or community comprehensive planning, land use and surface transportation plans are developed for the appropriate jurisdictions, with the airport and its influence area being a consideration and condition during its development. Planning for airports and their environs is essential at all these levels to best assure optimal directions for all community facilities and elements and the realization of the development potential of the airport and the surrounding area. Each of these approaches and the importance of an integration of these efforts is reviewed in the following documentation.

The Arizona Aviation System Plan

Airports are among the most widely used public transportation facilities in Arizona. Airports serve as the fulcrum for transporting passengers and goods in a state with geographical features that range from large metropolitan areas to remote Native American dwellings. While air carrier service is the primary means of travel to metropolitan areas outside the State, the commuter airlines provide an invaluable service in bringing passengers from the smaller cities and towns to the Phoenix and Tucson metropolitan areas. General aviation provides both business and recreational flying opportunities and access to many of the State's smaller communities.

During the past forty plus years, the State of Arizona has become a major growth center in the desert southwest. Arizona's climate and recreational opportunities have been key ingredients in the State's growth. Between 1970 and 1990, for instance, population more than doubled, increasing by over 104%, while employment almost tripled and per capita income more than quadrupled. The aviation industry has shared in this growth as well. The number of Arizona registered General Aviation aircraft nearly tripled between 1970 and 1985,

although there has been a decline since 1985, resulting in a net increase of about 150% during the two decade period. Further, the total number of commercial passengers in 1990 are more than six times greater than in 1970. Since 1985, there has been an increase of some 53% in passenger enplanements in Arizona, exceeding the State's population growth rate.

In response to trends in general and commercial aviation, the State of Arizona has developed the Arizona Aviation System Plan and an associated continuing aviation system planning process which is intended to maintain an up-to-date inventory of the State's airport facilities and aviation resources; to provide for cooperative planning between airports and surrounding communities; to frequently evaluate changing demands for air service; and to use this data in planning for essential air service and allocating funds for airport development and improvement projects.

There are presently some 212 airports and 76 heliports and helistops in Arizona. Because of the magnitude of this system, the State has developed a statewide airport classification system which includes Primary, Secondary and Emerging Rural airports. Collectively, this system serves nearly one hundred percent of the State's population, and includes Commercial Service and General Aviation public use airports. Presently, the Arizona Aviation System Plan includes 57 Primary System airports [of which 47 are Public, 4 are Private, and 6 are Native American-owned], 44 Secondary System airports [of which 15 are Public, 15 are Private, and 14 are Native American-owned], and 8 Emerging Rural airports. Additionally, there are 76 Private Rotorcraft facilities and 103 Other Private-Use facilities.

Primary System airports are defined as airports which meet the following criteria: 1) Airports which are open to the public [not necessarily publicly owned]; and, 2) Airports which have ten or more based aircraft, or 2,000 or more operations per year; or, 3) Airports with scheduled air service by an air carrier or commuter airline on a regular basis; or, 4) Airports which are projected to meet any one of these criteria within ten years. The other public-use airports in the State's system are classified as Secondary System airports. The public-use facilities in rural areas that are not yet registered with the FAA, but are being used by the flying public as airports, are called Emerging Rural Airports (ERAs). Once registered with the FAA, ERAs become Secondary System airports. The Secondary System airports are different in character form the State's Primary System airports. Since most of the Secondary System airports are located in rural areas, local populations do not generate sufficient aviation activity to populations to warrant the level of airport facilities generally associated with Primary System airports. The Secondary System airports provide only facilities that can be utilized by single-engine and light twin aircraft. They are not designed to serve business jets, heavy two engine aircraft, large commuter aircraft or commercial airlines.

The importance of aviation to Arizona demonstrates the need to develop this mode of transportation into a system and integrate it into the total Arizona transportation network. This is partially accomplished by the Aviation System Plan and the coincident

aviation system planning process. Findings of this Plan are then integrated into the overall transportation plan for the State of Arizona.

Briefly, the purpose of the Arizona Aviation System Plan is to ensure that the State has an adequate and efficient system of airports to serve it aviation needs well into the future. To address this purpose, the Plan identifies general airport facility needs and the resources required for accomplishment, providing a basis for coordinating regional and local airport planning activities. Additionally, the Federal Aviation Administration is able to use the information and findings culminated in the System Plan in evaluating Federally-eligible projects and resource allocation.

Comprehensive Planning

Comprehensive regional and community planning in itself offers an opportunity for establishing compatible conditions within the areas of the community surrounding an airport. While these planning efforts are concerned with all elements of the community and the interrelationship of these facilities and conditions, specific plans can be developed for those geographical areas which are influenced by the airport and which, in turn, may influence the future development potential of the airport. It is an opportunity to view the airport as a community facility, its economic and environmental impact on the community and perhaps region, and its role in the total local, regional and state transportation system.

With the completion of either the community's comprehensive plan or the region's future land use plan, the land anticipated for airport purposes should be shown as should the designation of land uses for that area surrounding the airport and potentially influenced by its operations. Proposed land uses within the airport's influence area should be based on sound planning practices. A reasonable basis for determining compatibility is the land use guidelines described in Part 150 of the Federal Aviation Regulations (FAR). This is further discussed in the following documentation.

Through the comprehensive planning process, land use regulations can be developed and implemented to promote land use compatibility within the airport environs as well as to enforce sound land use planning practices which are consistent with the association of an aviation facility. If a comprehensive plan has been developed and is used regularly, the available regulatory measures have consistent application and the likelihood of realizing the goals and recommendations of the plan is significantly enhanced. Among the various land use controls which most commonly may be available for promoting compatibility between the airport and its environs are zoning, subdivision regulations, easements and building codes, with other controls such as transfer of development rights and capital improvement programming having potential application.

Many communities in Arizona have prepared comprehensive plans which do accomplish the objective of establishing guidelines and a program for achieving compatibility between the airport and its environs. Others, have not; if the airport has not been a consideration or the comprehensive plan is not representative of current or desired conditions, then the community should take steps to

update the plan to the benefit of its populace and the protection of the airport as a vital community facility and community asset.

Airport Planning

There are four generally accepted levels of planning. These include the *national* level, the *state* level, the *regional/metropolitan* level, and the *local* level. Each of these are introduced here as well as locally based planning programs for airports and their environs.

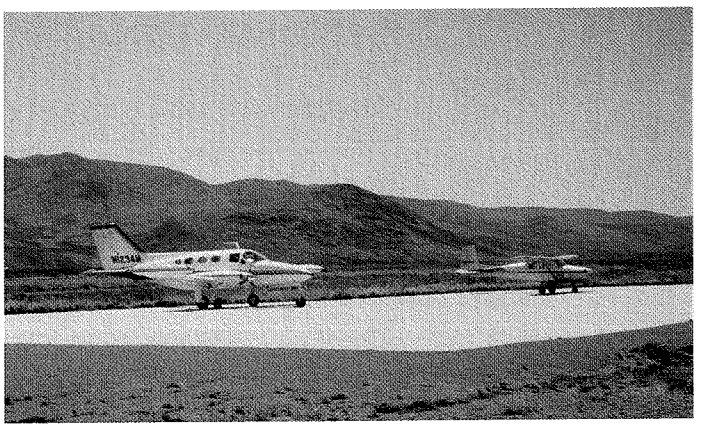
National Level of Planning

The Federal Aviation Administration (FAA) is responsible for airport planning at the national level. The National Plan of Integrated Airport Systems (NPIAS) is a ten-year plan which is continually updated and published every two years by the FAA. The NPIAS is a product of the Airport and Airway Improvement Act of 1982. The Act requires the Secretary of Department of Transportation to publish a national plan for the development of public-use airports in the nation. This national plan lists the public use airports and associated development which is considered to be in the national interest and thereby eligible for financial assistance for airport planning and development under the 1982 Act. The 1982 Act requires geographical (airports in a region should be considered collectively) and intermodal (planning for an individual airport should be part of the planning process for the overall regional transportation system) integration in the planning process. For example, as an airport master plan is prepared, the process should not be done in isolation, but in consideration of the development of a system of aviation facilities.

State Level of Planning

Airport planning at the state level can take several forms. These may include participating in the development of a state aviation system plan; funding all or a portion of the preparation of an airport master plan; and, providing technical assistance in the development of an airport master plan. Obviously, the type and magnitude of involvement can and will vary according to the particular needs of the state or a specific airport. Some forty-seven states have an aviation agency that is responsible for airport planning to some degree. Arizona is no exception; the Arizona Department of Transportation/Aeronautics Division is among the most active states in terms of aviation system planning and the planning of individual airports and their surrounding environs.

The state aviation system plan typically identifies the general location and characteristics of new airports and the general expansion



needs of existing airports to meet statewide air transportation goals. However, as is the case in Arizona, the state aviation system plan can vary significantly in approach and content; the plan is sophisticated and regularly monitored, updated and used to program and allocate funds.

State planning should be reflective of the individual airport master plans. But, as with national planning, the airport master plan should recognize state-wide goals and actions in terms of other area airport and total transportation system coordination to the extent practical and appropriate to the needs of the individual airport.

Regional/Metropolitan Level of Planning

This level of aviation planning typically identifies airport needs for large regional or metropolitan areas. Needs are stated in general terms and incorporated into statewide system plans. However, regional or metropolitan airport planning has a certain uniqueness about it as a level of planning in that an airport hub serve as the center of the analysis and encompasses a geographical area which generally corresponds with that of a defined metropolitan area. The plan encompasses the full spectrum of regional air transportation needs, including those at both small and large aviation facilities. Actually, the practice of regional planning is relatively new, initially instituted to focus on resource allocation among airports in a specific geographical area which have developed rather independently and have lacked coordination consideration to the benefit of the aviation system as a whole.

In this regard and certainly in support of this level of planning, the regional or metropolitan aviation system plan, in providing aviation activity forecasts for the particular study area, also provides an allocation of such anticipated traffic among the airports in the region or metropolitan area. The plan for individual airports generally focuses on aviation activity at an airport singularly, with emphasis on approaches to enhance aviation activity which is in the interest of that airport. If balance among airport is not considered in planning for a particular facility, any projections of aviation activity contained in the plan which are not attained, as well as any proposals based on these projections (which are only achievable if the projections are realized) may lead to the plan not being used due to its resultant inaccuracies and perhaps inappropriateness. Recognition of surrounding conditions must be a requisite of plan development, with the regional plan or familiarity with regional airport planning serving to evaluate and test the balance of proposed activity levels and the appropriateness of the plan for an individual airport.

Local Level of Planning

Airport planning at the local level is represented by the airport master plan and the associated process of deriving the plan. The master planning process affords an opportunity to meld many and various considerations about the community and airport into a mutually beneficial program. It provides an opportunity to formulate a plan and program which can be supported by the community and will allow the airport to become an even more viable element of the community. It also provides the opportunity to determine resolution to such issues as those involving off-airport compatibility, transportation needs and economic development. In more recent years, these types of considerations have become a part of the

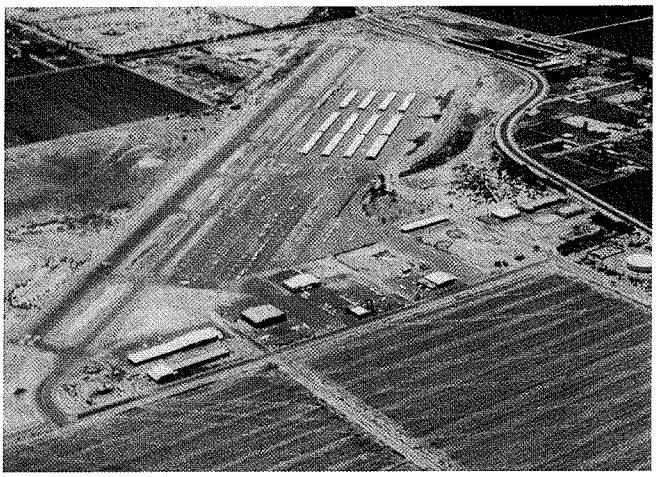
planning process. Generally speaking, and in Arizona in particular, airports are now being planned collectively with other elements of the community, with a sense for the airport environs, and with public involvement as a means of furthering its support and enhancing its development and service potential.

Because of its local nature, with more concentrated interest and more intense activity compared with the airport activities on a larger scale, the airport master plan will be subjected to more scrutiny and will involve a broader spectrum of individuals and groups. This feature makes it imperative that the plan be developed in a public forum and as a coordination effort of the interest groups. Public acceptance of the plan is essential if the plan is to be successful. It is here that the airport and the surrounding area can be planned and programmed in a coordinated manner that subscribes to compatible relationships between these elements of the community.

In terms of planning efforts, three of the four levels of planning are funded through the Airport Improvement Program (AIP) administered by the Federal Aviation Administration (FAA). These include state aviation system planning, regional or metropolitan airport system planning, and individual airport master planning. Prior to the most recent funding legislation (established by the Airport and Airway Improvement Act or 1982), the program for funding airport planning activities was the Planning Grant Program (PGP), which was fostered by the Airport and Airway Development Act of 1970. The corollary funding program for airport development was the Airport Development Aid Program (ADAP). With the Act of 1982, both airport planning and airport development became fundable through a single program. This latter legislation, as amended by the Airport and Airway Safety and Capacity Expansion Act of 1987, continues to provide funding for both airport planning and development.

Airport Master Planning

In many respects, the content of airport master plans has principally remained consistent over the past years; however, the approach to, and even the final product, has changed, particularly in more recent times. This is, no doubt, a reflection of enhanced technologies, greater demands being imposed on the airport to plan for the future in part brought on by financial constraints, competitive influences, and operational pressures. There is also the realization by the populace that airports are now the total transportation center being a major collection and distribution center for both people and goods. Airports are rapidly



becoming totally self-contained units, communities within themselves which offer living, shopping, working and recreational needs and services.

The relationship of the airport and the area surrounding the airport is of major concern, as airports and those administering these facilities have long realized the need for sound planning, contrary, frankly, to those administering the jurisdictions which surround many airports. Perhaps this is a generalization, but a very true issue in far too many instances. It is a basic responsibility of an airport master plan to foster positive relationships through the coordination of the plan's development with those entities and jurisdictions which are or potentially are influenced by the operations of the airport. Unfortunately, the airport master plan is not a mandate nor is it legally binding; however, it is an opportunity to meld the thoughts and concerns of all interested parties into a mutually accepted guide for airport development.

The airport master plan is the *sponsor's* plan. It is a program developed by the sponsor for the airport based on the goals of the sponsor and needs of the airport and the community. The plan is *accepted* by the Federal Aviation Administration, but not *approved* by this agency.

Under the umbrella term *planning*, which is a continuing process requiring current data and information and current conclusions and recommendations, there are many types of activities. There is a rather intrinsic interrelationship among these planning activities which range from macro level planning to micro level, and from specific airport concerns to off-airport and surface transportation issues. However, all levels of planning and many types of planning activities are considerations in determining the future of an airport.

The airport master plan and the associated planning process can be simple, or it can be rather complex; it can be plain or sophisticated; it can be brief or lengthy. While its character, so to speak, can be different, the airport master plan is usually representative of the particular airport in terms of level of magnitude and sophistication. Typically, the smaller airport does not require or warrant a plan and program of great proportion. However, the larger airports, due to greater facilities, greater demand, more activity, and the need for greater capital improvement projects, do require a more complex, and perhaps even more encompassing plan for future development. Regardless of the airport or the level of magnitude, the airport master plan should be comprehensive in nature and appropriate in content. Additionally, it should explore all possibilities for the airport and represent the needs of the airport. It is not necessary or even appropriate that every potential master plan element be included in every master plan document without consideration of the particular airport facility. In fact, it could certainly be suggested that the plan may consist of no more that the Airport Layout Plan at a small general aviation facility, whereas the plan for a larger facility, be it general aviation, commercial service or air carrier, may consist of significant planning and environmental documentation, a series of maps and various computer applications.

So, it can be quickly noted that the size, magnitude and coverage of the airport master plan can vary. However, one should be equally

quick to note that the definition of the airport master plan does not change. It still remains a guide to future airport development. It still provides a profile, narratively and graphically described, of ultimate airport development. It still establishes the policies of the airport's sponsoring entity. It still represents a program for accommodating aviation demand and community needs at the facility in light of environmental congruity, environs compatibility, surface transportation synchronization and other area airport coordination. In terms of a specific definition, the airport master plan is simply a documented representation of the future airport. It is the official statement of the decision-making body and represents a commitment on the part of the governing entity.

The master *plan* is also a master *program*, in that, in addition to describing and illustrating desired ends, it also specifies the means for achieving these ends. The implementation element of the master planning process is a vital ingredient by indicating schedules, priorities, cost estimates and responsibilities.

The Airport Layout Plan

The Airport Layout Plan (ALP) provides a concise representation of all past efforts of the airport planning process, graphically presenting the transition from goals, concepts and requirements to the development of specific plans for the airport. This plan, a public document which is a record of aeronautical requirements, both existing and proposed, provides an overall depiction of the development of the airport and its operational influence area. It is also a reference for community deliberations on land use proposals and budget and resource planning. Further, it is referred to by the Federal Aviation Administration in its review and findings on proposals involving the development of the airport for which the ALP is prepared and of other nearby airports and objects which may affect the navigable airspace.

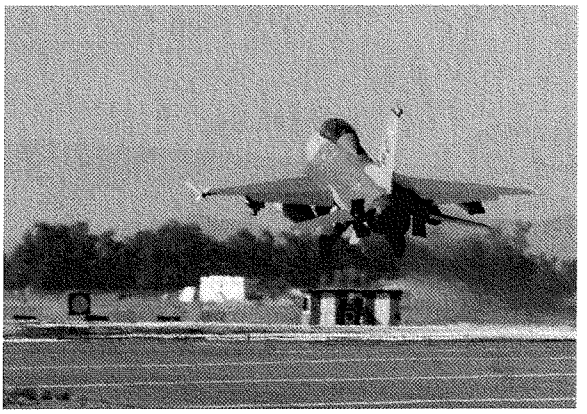
For airports which have received or are receiving federal financial assistance, the ALP must always be kept up-to-date and must meet the requirements as set forth in the Airport and Airway Safety and Capacity Expansion Act of 1987. An up-to-date ALP means one which accurately reflects current regulations and design criteria and accurately reflects existing and planned construction on the airport.

The Airport Layout Plan itself is generally a part of an airport plans set. Other plans in this set of drawings may include an Airport Airspace Drawing, a Runway Protection Zone (RPZ) Drawing, a Terminal Area Drawing, a Land Use Drawing, and an Airport Property Map. At a minimum, the Airport Layout Plan is accompanied by the Airport Airspace Drawing [includes a plan view of all FAR Part 77 surfaces normally based on ultimate runway lengths, small scale profile views of existing and ultimate approaches, and obstruction data tables as appropriate] and the Runway Protection Zone Drawing [includes large scale plan views and projected profile views of inner portions of approaches, usually limited to the RPZ areas, obstruction data tables, and interim stage RPZs when plan for interim runway extensions are firm and construction of such extensions is reasonably assured in the near future] which technically constitutes the Airport Layout Plan set. Additionally, it may be appropriate for an airport to have other separate

drawings as a part of the airport plans set such as a master utility map, noise contour map, among others, the execution and inclusion of which would be commensurate with the needs of the particular airport.

Noise Exposure and Land Use Compatibility Planning

The Federal Aviation Administration has published guidelines for controlling noise and establishing compatibility between the airport and its environs. These guidelines are defined in Part 150 of the Federal Aviation Regulations (FAR), with the planning studies focusing on airport noise control and land use compatibility being more popularly referred to as FAR Part 150 studies. The purpose of an FAR Part 150 Noise Exposure and Land Use Compatibility Program, as it is more formally described, is to assess the noise environment at and within the vicinity of an airport, to prepare forecasts of aviation operations, to identify land uses within the airport environs, and to explore ways to mitigate land use compatibility conflicts. The resultant outcome of such a study is to reduce the number of people affected by noise, consistent with airport operations. The FAR Part 150 Study, a detailed analysis of noise abatement and compatibility planning measures, obviously focuses on airport and environs compatibility, whereas the airport master plan, while considering such issues, emphasizes airport development and the associated improvement program.



The development of realistic and effective alternatives is the focus of the FAR Part 150 study process, with the overall objective being to explore a wide range of feasible alternatives of land use patterns, noise control actions and noise impact patterns. Solutions can then be derived to accommodate both airport users and inhabitants of the airport's environs within acceptable safety, economic and environmental parameters. Further, this planning process involves significant public involvement.

The FAR Part 150 Program is typically accomplished concurrently with or shortly after the completion of the airport master plan, thereby assuring that the base data, forecasts and other complimentary information is current and consistent and that the alternative measures for airport development are appropriate to airport environs impact. If an airport master plan is outdated as the FAR Part 150 study is commenced, then an update to the master plan should be undertaken in association with the noise and land use compatibility study. The approval of an airport's FAR Part 150 Noise Exposure and Land Use Compatibility Program by the Federal Aviation Administration qualifies that airport sponsor for federal funding for appropriate noise abatement measures identified in the Program.

Other Compatibility Studies

Similarly, the U. S. Department of Defense has also developed

guidelines for land use compatibility for military air bases and the areas which surround these installations. This program is referred to as an Air Installation Compatible Use Zone Program (AICUZ). This program is similar in content and intent to the FAR Part 150 Program, but is specifically for and directly responsive to military air base needs and the uniqueness of such facilities and associated operations.

Obviously, the impact of the operations at an airport on the area surrounding and influenced by the airport's activities is an important consideration in all of the above described planning processes. Each of these processes provides an opportunity for analyzing the airport's impact on the land uses within the airport environs. Plans and regulatory recommendations for compatible land use should be a component of both the specific airport plan, as described above, and the community's land use or comprehensive plan, which is described later in this document.

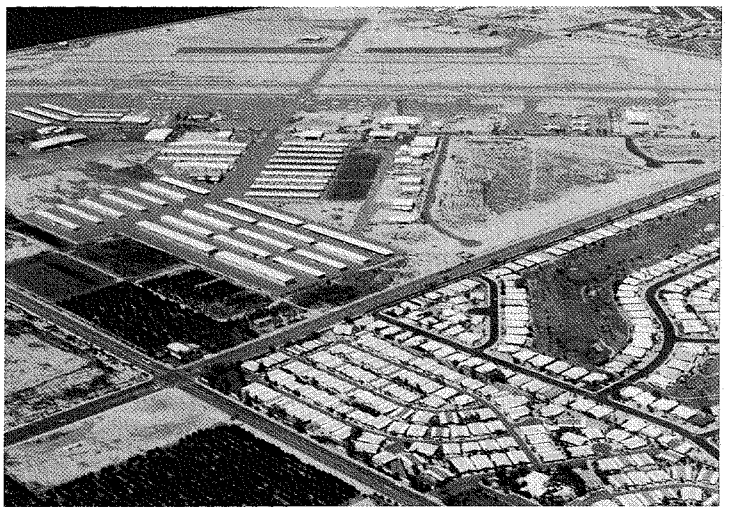
Integrated Planning

Certainly, any of the types of plans or planning processes discussed above can be approached independently whether it is state or regional aviation system planning, individual airport master planning, or community planning. However, the integration of these planning programs can result in more effective short- and long-term results, particularly in terms of developing a truly compatible relationship between the airport and the community and maximizing the resources available to direct and contribute toward implementation.

The level of consideration and resultant recommendations obviously vary among each of these levels and types of planning activities. The system plan will view individual airports in a more general sense, prescribing projects and needs within the purview of the state aeronautical agency and identifying the resources required for plan realization and appropriate allocations in light of the needs of the aviation system as a whole. The airport master plan is a detailed analysis of the airport, providing quite specific recommendations and denoting the full range of projects, needs and costs for appropriate airport development. Both levels of airport planning include provisions and plans for establishing compatibility between the airport and its environs. Since the governing body of the airport does not always have jurisdiction of the areas within the airport's influence area but which are beyond the airport's boundaries, it is essential that community planning take the responsibility of developing appropriate land use plans within the vicinity of the airport and provide the land use controls for implementing the plan's recommendations.

The regional or community comprehensive plan, while providing a guide for land use decisions, should be based on considerations of airport impact and development needs. Typically, the airport's impact is based on aircraft-generated noise which is expressed through the development of noise contours. The noise contours for a particular airport are computer-generated and are based on aircraft operating and noise emission characteristics, the type of the aircraft using the facility, the number and types of aircraft operations at the airport on an annual basis, and certain prevailing conditions (i.e., airport elevation, temperature), among other considerations depending on the individual airport. With the noise

contours developed and an understanding of appropriate land uses within the various noise contours, very suitable land use plans can be formulated in the comprehensive plan and land use controls can be adopted as a means of establishing and ultimately realizing compatible relationships between the airport and its environs.



Overall, there are few land use compatibility problems in association with airports in the State of Arizona, with approximately 1,151 acres of residential land currently being within the DNL 65 noise contours at the primary airports within the state, collectively, 242 acres within the DNL 70 noise contours, and 81 acres within the DNL 75 noise contours, according to a recent inventory and assessment of aircraft noise related land use issues at the State's 57 primary system airports. As may be expected, the majority of these issues occur at the primary commercial service airports, including Phoenix/Sky Harbor International Airport and Tucson International Airport, at which there are 578 acres and 335 acres of residential land use within the DNL 65 noise contour, respectively; 41 acres and 40 acres within the DNL 70 noise contour, respectively; and none at either airport within the DNL 75 noise contour. Together, this represents 79.3% of the total residential area within the DNL 65 noise contours statewide (primary system airports only), 33.5% of the total residential area within the DNL 70 noise contours. Further, on a statewide basis, there are 18 instances of land uses in addition to residential use which are considered to be incompatible by accepted standards within the DNL 65 noise contours, 2 within the DNL 70 noise contours, and none within the DNL 75 noise contours. These consist of 6 schools, 12 churches, and no hospitals in the DNL 65 noise contours; 1 school, 1 church, and no hospitals in the DNL 70 noise contours; and no schools, churches or hospitals in the DNL 75 noise contours. Again, these are totals for the primary system airports.

While the problems may be relatively small on a statewide basis at the primary system airports, and significant measures have been and are being taken at airports where the issues are most significant, the potential for increased occurrences of land use incompatibilities remains, even at airports which are not now faced with such adverse situations. An awareness of these potentials and, perhaps most importantly, the need to implement measures to counteract and prevent land use incompatibilities is apparent as the demand for air travel continues to grow in the state and development demands on land within the influence area of an airport continues to be evident.

Additionally, the cost of mitigating adverse conditions continues to increase as well. While preventive measures are the best prescription for avoiding land use incompatibilities, and in most cases are less costly than implementing mitigation programs such as, for example, soundproofing, acquisition and relocation programs, and construction of airport facilities for noise mitigation purposes, the direct and indirect expenses associated with these measures continues to rise as well. As development pressure on currently vacant land or on land that presently contains a use which is compatible continues to escalate, the cost of prevention certainly rises commensurably in many cases. It's conceivable, then, that the costs, either direct or indirect, can reach a point that the options for reducing land use impacts from aircraft operations center on physical and operational constraints at the airport. This can simply lead to a reduced level of benefit to the community derived from activity at and made possible by the airport. However, such adverse and undesirable situations can be avoided and resolved with the participation and cooperation of all levels of government, including federal, state and local, in the airport and land use planning process and through the implementation of an effective planning and land use controls program for both airports and communities.

Responsibilities of Federal and State Government

The federal government has the authority and responsibility to control aircraft noise by the regulation of source emissions, by flight operational procedures, and by management of the air traffic control system and navigable airspace in ways that minimize noise impact on residential and other noise sensitive areas. The federal government also provides financial and technical assistance to airport operators for noise reduction planning and abatement activities, and conducts research into noise abatement technology. However, the federal government has no land use control authority as a means of controlling the development of incompatible land uses within the airport environs. This is within the authority of the local government.

The Airport Noise and Capacity Act of 1990 set the National Noise Policy concerning the phase out of louder aircraft (Stage 2) and the phase in of quieter aircraft (Stage 3). This set the framework for a nationwide reduction in noisy aircraft by approximately the year 2000. Generally speaking, only the quieter Stage 3 commercial service aircraft will be allowed to fly within the United States by the turn of the century. In addition, through the FAR Part 150 Program, the federal government, extends grants administered by the Federal Aviation Administration, to provide funds for local airport Sponsors to undertake aircraft noise and land use compatibility studies. The goal of a Part 150 Program is to reduce the number of incompatible land uses affected by aircraft operational procedures changes, airport facility changes and land use changes. This is a voluntary program undertaken by the local airport Sponsor in an effort to reduce or eliminate off-airport aircraft noise intrusion.

The State of Arizona, through the Aeronautics Division of the Arizona Department of Transportation, provides advice and assistance of a technical nature to communities, counties and other entities of local government in airport planning and land use planning and zoning on an ongoing

basis. Additionally, the Aeronautics Division allocates funds to be used toward the development of airport plans and regulatory mechanisms, either full funding (in association with Sponsor participatory funds) for certain planning programs or in concert with funds allocated by the Federal Aviation Administration (also in concert with Sponsor participatory funds) for planning purposes, and for various airport developmental projects on the same funding basis. In addition, it is the responsibility of the state to provide enabling legislation for the development of off-airport land use controls by the local jurisdictions having land use control authority in an effort to reduce potential land use incompatibilities.

Responsibility of Local Government

Local government basically has the responsibility for planning and creating implementation measures for the purpose of reducing the effect of aircraft generated noise on noise sensitive land uses within the environs of the airport. The locality has several potential options available to exercise this responsibility, with some of the more common actions including noise abatement procedures, land acquisition programs, certain airport operational restrictions, and noise mitigation inspired improvements to the airport, to mention a few. These and any other actions are proper provided they do not unjustly discriminate against any user, impede safety, or unreasonably interfere with interstate or foreign commerce. Additionally, local government is also responsible for land use planning and development, zoning controls and subdivision regulations that will limit the use of land near an airport for purposes considered to be compatible with airport operations. Generally, these areas in which controls are implemented are clearly marked areas influenced and in essence defined by the established and accepted noise contours which are representative of existing and future conditions.

It must be remembered that neither the local government nor the airport proprietor has the authority to control aircraft flight procedures or where aircraft fly once they leave the airport. This is solely within the purview of the federal government. However, the airport proprietor can work with the Federal Aviation Administration to mitigate, to the extent possible, the affect of aircraft flight procedures on adjacent land uses. However, within the limitations of the National Noise Policy, the airport Sponsor can take reasonable airport restrictions. Any such restrictions should be coupled with off-airport land use controls to ensure land use compatibility.

The responsibility of any local governmental entity should be supported by the responsibility of both the aviation community as well as the residents of that community. Airport operators and users as well as those residing within an area actually influenced by airport activity and operations are primary players in working collectively with the local governmental entity to resolve existing incompatibility issues and prevent future occurrences. With proper planning, effective coordination and communication, cooperation, and sound implementation measures, airport and airport environs compatibility can be achieved. The Arizona Department of Transportation/Aeronautics Division fully supports airports and communities in reaching their objectives in terms of accommo-

dating the demands placed on an aviation facility within a compatible environment, strongly encouraging localities to plan for the future of the airport and the environs of the airport through the development of plans and controls to protect both and allow both to reach full and mutually beneficial development potential.

In summary, the state aviation system planning process is the responsibility of the State of Arizona Department of Transportation/Aeronautics Division and is presently a very active function of the Division. Metropolitan area system plans have typically been the responsibility of regional agencies such as the respective Council of Governments. Airport sponsors (owners of airports) are responsible for initiating airport master plans for their respective airports, preparing such plans in conjunction with the FAA and the Aeronautics Division. Individual regions and communities have the responsibility of preparing comprehensive plans for their respective areas of jurisdiction. It is very common and accepted procedure for representatives of any of these noted entities to serve on committees charged with the preparation and development of any of these plans other than that planning program with which one normally deals. Through this procedure, and other coordination procedures as well, coordination in plan development is reasonably assured and the benefits of integrated planning is realized.

Introduction

The protection of pilots, airports and surrounding land uses is a vital issue facing many airports and communities which must be continually addressed in creating and maintaining a safe operating environment at and within the vicinity of all airports. The air to surface transition areas which accommodate aircraft as they approach and depart airports and the air route structure must be clear of all obstructions and land uses which could be potentially hazardous to the safe operation of the aircraft and inhabitants of the area around airports. Obstacles which can affect such safe operation come in many forms, including transmission towers, power poles and lines, antennas, smoke stacks, trees, high-rise buildings, and any other structure which rises above the ground within established control areas (referred to as *imaginary surfaces*) around the airport that may pose a potential obstruction to air navigation.

The boundaries of height hazard zoning are usually defined by Federal Aviation Regulations (FAR) Part 77 criteria which provides obstruction clearance requirements at or near airports. The FAR Part 77 height hazard map and associated ordinance can very easily be adopted as part of a community's traditional zoning code and incorporated into the overall development code for a community. The map and regulations usually act as an overlay zone, with underlying traditional land use zoning applying for all land uses unless that zone allows uses which conflict with the height hazard zone. This is a very traditional type of land use control which protects the airport from obstructions and hazards to air navigation. It should be remembered that the Federal Aviation Administration has no land use control authority and it is the responsibility of the local unit of government to control the height of objects within the vicinity of an airport. There are many instances wherein the development of a structure which poses an obstruction to the full utilization of an airport has limited the use of a runway or runways (resulting in such actions as displaced or relocated landing thresholds and inhibiting the use of instrument approaches) and, in some cases, has caused the closing of a runway or even an airport. Through proper regulation and jurisdictional cooperation, however, these interferences and issues can be avoided.

Elements of Height Zoning

Whether an object is an obstruction to navigable airspace is based on imaginary surfaces which are established in relation to the airport and to each runway. FAR Part 77 defines imaginary surface as that area above which objects on the ground cannot protrude without constituting an obstruction to air navigation. There are several imaginary surfaces defined as part of FAR Part 77, with the size of each depending on the type of approach planned for a particular runway (i.e., visual, nonprecision or precision approach). Runways are classified as either utility runways (limited to use by aircraft having a maximum gross weight of 12,500 pounds or less) or larger than utility runways.

Each of the imaginary surfaces is exhibited in an accompanying illustration and further defined as follows:

A *primary surface* is longitudinally centered on a runway. When the

runway has a hard surface, the primary surface extends 200 feet beyond each end of that runway, but ends at each end of a runway which is not hard surfaced. The width of the primary surface is dependent on the type of runway with which it is associated. The width of the primary surface ranges from 250 feet for visual runways to 1,000 feet for precision instrument runways as prescribed for the most precise approach existing or planned for either end of the runway.

A *horizontal surface* is a horizontal plane 150 feet above the established airport elevation, the perimeter of which is constructed by swinging arcs of specified radii from the center of each end of the primary surface of each runway of each airport and connecting the adjacent arcs by lines tangent to those arcs. The radius of each arc is 5,000 feet for utility or visual runways and 10,000 feet for all others, with the radius of the arc for each runway end being the same based on the highest value.

A *conical surface* extends outward and upward from the periphery of the horizontal surface at a slope of 20 to 1 for a horizontal distance of 4,000 feet.

An *approach surface* is longitudinally centered on the extended runway centerline and extends outward and upward from each end of the primary surface. An approach surface is applied to each runway end based on the existing or planned approach type for that particular runway end. The approach surface extends horizontally for varying distances and angles, again depending on the type of approach [visual (20:1), nonprecision (34:1) or precision (50:1)].

Transitional surfaces extend outward and upward at right angles to the runway centerline and the runway centerline extended at a slope of 7 to 1 from the sides of the primary surface and from the sides of the approach surfaces.

The FAR Part 77 surfaces and their resultant relationships as they relate to a particular airport and surround area are typically illustrated on a drawing called the *Airport Airspace Drawing*. This illustration is composed of three specific items, including a plan view of all FAR Part 77 surfaces normally based on ultimate runway lengths, small scale profile views of existing and ultimate ap-

proaches, and obstruction data tables as appropriate. For guidelines relating to the development of this drawing, Appendix 7 of FAA Advisory Circular 150/5300-13, *Airport Design*, can be consulted.

Developing and Passing an Ordinance

The implementation of a Height Zoning Ordinance is within the jurisdiction of the local government having land use control authority and is governed by state enabling legislation addressing such an ordinance. However, the Federal Aviation Administration has developed a Model Ordinance, based on FAR Part 77 which should be used as a guide, subject to state legislation, for developing such an ordinance.

It is common with many airports, both in urban and rural settings, that the Part 77 surfaces will be contained within many different jurisdictions, most of which are not the Sponsor of the particular airport generating those surfaces. In such instances, a joint airport zoning board is authorized to develop and administer the ordinance. The Arizona Airport Zoning Act (ARS Title 2, Section 301 *et seq.*) enables political subdivisions to adopt, administer, and enforce airport zoning regulations to control airport hazards. This applies to both cities and counties who are airport sponsors. In addition, the statute also allows such political subdivisions to adopt such ordinances to protect military bases within their jurisdiction from airport hazards. The local ordinance must be adopted in accordance with that statute, with the opportunity for the public to comment on the ordinance prior to final adoption and implementation.

Implementation of Airport Environs Plans

In concert with various noise abatement and mitigation solutions in the process of establishing a compatible environment from the perspective of the airport and its associated activities, involving facility or operational modifications, there are several approaches to implementing plans for the airport environs from the perspective of the surrounding jurisdictional entity. Some can serve as adequate solutions singularly, while others can be used in concert with another involving a combination of techniques to achieve the desired objective of establishing a compatible relationship between the airport and its environs. Further, some of the means are regulatory (enacted under the State's police power where the state has delegated specific powers to municipalities to protect and promote the health, safety and general welfare of the public) in nature, while others require actual expenditures (through a community's budgetary and administrative process) resulting in land ownership or facilities modification and development. Examples of these measures include land acquisition, easements, advanced property acquisition, land use zoning, condemnation, airport height zoning, subdivision regulations, building codes and capital improvements programming. It is important to note that the implementation of many of these techniques as a preventive action will be significantly more effective that as a corrective action. Obviously, corrective actions are more limited in number and will result in greater overall costs for achieving compatibility as well. Following is a brief description of these actions which are presented for consideration by various jurisdictional bodies during the land use implementation process. This is not intended to necessarily be an all-inclusive list of potential actions, but to simply provide an overview of the techniques which are available as conditions dictate. The approach or approaches to be taken in establishing a compatible environment between the airport and the community is a local decision and should be considered and accomplished within local legal and policy parameters.

Land Acquisition. The acquisition of land is perhaps the most certain of the techniques discussed here in that fee simple ownership of land provides the full ability to control the use of land subject, of course, to the various regulatory provisions which may be applicable to the particular property.

Easements. An easement is the right held by one to make use of the property of another for a limited purpose. Two specific types of easements are usually referenced in airport planning, a *positive* easement which would allow the generation of noise over the land or a road through the land, for example, and a *negative* easement to prevent the creation of a hazard or obstacle on the property of another.

Land Use Zoning. Zoning is the most common and traditional form of land use control used in the United States today. It controls the type and placement of different land uses within designated areas. It is used to encourage land use compatibility, while leaving property ownership in the hands of private individuals or business entities, thus leaving the land on the tax roles. Zoning is not applied retroactively, and is not necessarily permanent. It is most effective in areas not presently developed, and which can be encouraged to develop with compatible uses.

Condemnation. The process of acquiring property by eminent

domain is referred to as condemnation. Eminent domain is the right of public entities to acquire any property needed for statutory purpose. The public entity acquiring the property, through condemnation, in fee simple or as an easement, immediately takes possession of the property by paying the owner of the property an appraised value. However, if the property owner is not satisfied with the offered amount, the property owner may initiate legal proceedings, with the public entity responsible for paying the adjudicated price.

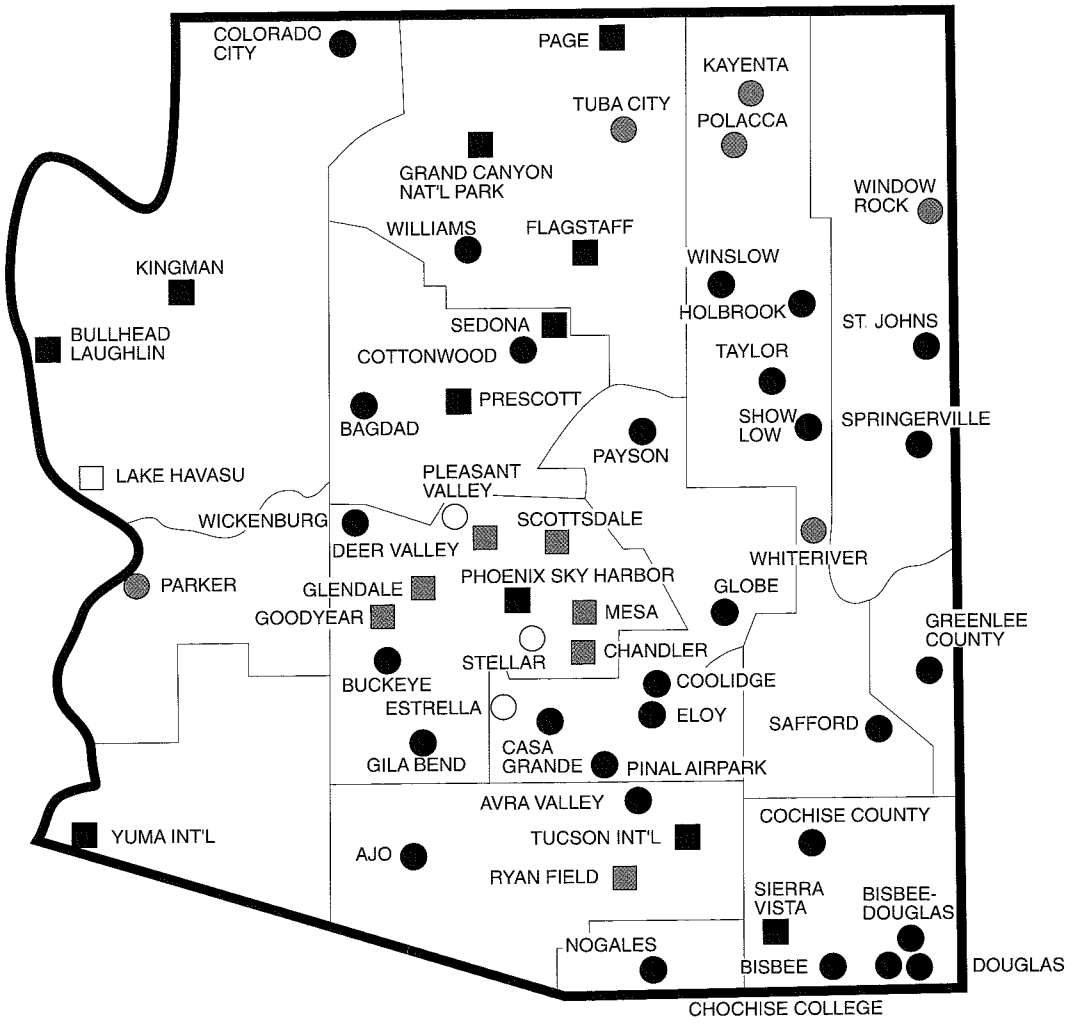
Airport Height Limitation Zoning. Municipal owners of airports have the authority The imposition of height limitations on structures within the vicinity of airports by public entity owners is generally referred to as height hazard zoning. The boundaries of height hazard zoning are usually defined by Federal Aviation Regulations (FAR) Part 77 criteria which provides obstruction clearance requirements at or near airports. The FAR Part 77 height hazard map and associated ordinance can very easily be adopted as a part of a community's traditional zoning code and incorporated into the overall development code for a community. The map and regulations usually act as an overlay zone, with underlying traditional land use zoning applying for all land uses unless that zone allows uses which conflict with the height hazard zone.

Subdivision Regulations and Plat Review. Subdivision regulations are used to control the design and placement of public and private facilities in the conversion of raw land to developed property.

Building Codes. Building codes are designed to insure the safe construction of buildings. The purpose of utilizing building codes in the airport and environs compatibility planning process is to achieve specific sound attenuation objectives within areas impacted by aircraft noise by modifying existing and potential building codes to include appropriate standards.

Capital Improvements Programming. This is a program that establishes priorities and costs on the funding and development of public facilities. It can be used successfully, in concert with subdivision regulations and a comprehensive plan, to control not only the areas of development, but the timing of development by controlling the timing and location of public facilities.

Transfer of Development Rights. The transfer of development rights involves separate ownership of the "bundle of rights" associated with property ownership. The concept involves the transfer of the right to develop a certain parcel of property to a certain density/intensity to another parcel of property under separate ownership. This would allow the property that obtains the added development rights to develop to a density/intensity beyond that which would normally be allowed. The airport can also purchase these rights from the landowner and retain them or sell them to another landowner. This concept can be used to retain property in compatible uses and still compensate the landowner for any loss of development. The idea depends upon market conditions of the area and upon the availability of state enabling legislation authorizing the development of the concept at the local level.

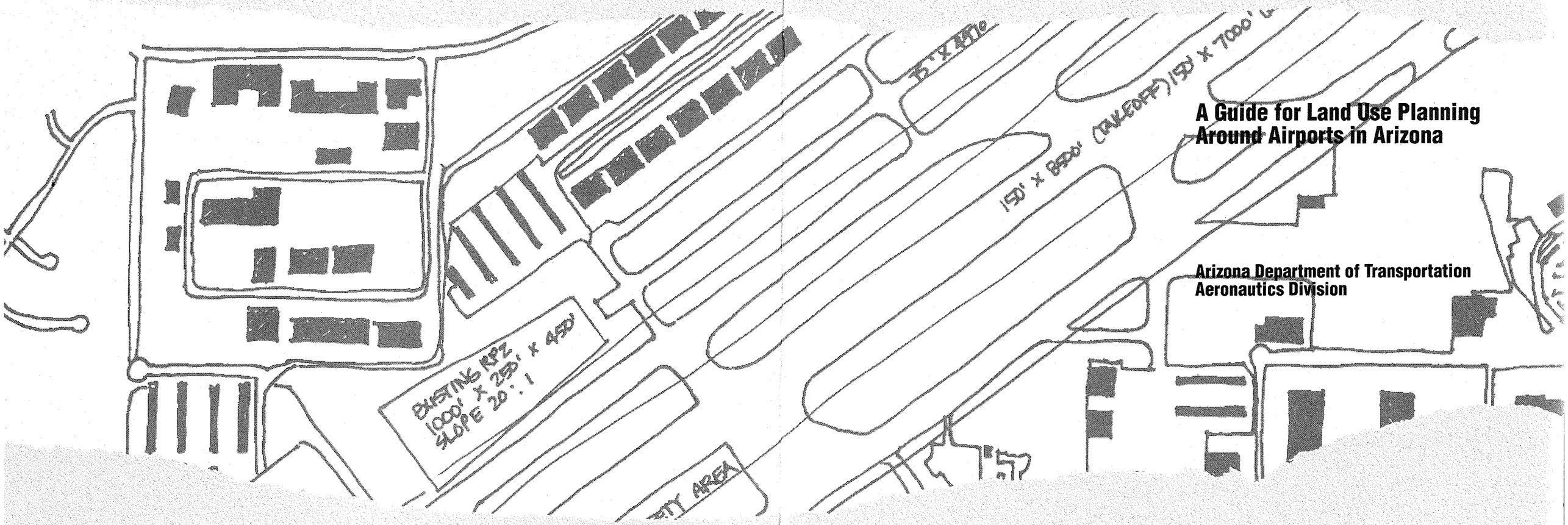


Primary Airport System Map

State of Arizona

- Commercial Service Airports/Public
- Commercial Service Airports/Private
- Reliever Airports/Public
- General Aviation Airports/Public
- General Aviation Airports/Private
- General Aviation Airports/Native American

Barnard Dunkelberg & Company
Cherry Street Building
1616 East Fifteenth Street
Tulsa, Oklahoma 74120
918/585-8844



A Guide for Land Use Planning Around Airports in Arizona

Arizona Department of Transportation
Aeronautics Division